

LONDON- WEST MIDLANDS ENVIRONMENTAL STATEMENT

Volume 5 | Technical Appendices

CFA16 | Ladbroke and Southam

Survey reports (CH-004-016)

Cultural heritage

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Department
for Transport

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Appendix CH-004-016

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Appendix name:	Survey report	004
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1 Introduction

1.1 Structure of the cultural heritage appendices

1.1.1 The cultural heritage appendices for the Ladbroke and Southam CFA (CFA16) comprise:

- Appendix CH-001-016 – Baseline report;
- Appendix CH-002-016 – Gazetteer of heritage assets;
- Appendix CH-003-016 – Impact assessment table; and
- Appendix CH-004-016 – Survey reports (this appendix).

1.1.2 Maps referred to throughout the cultural heritage appendices are contained in the Volume 5 cultural heritage map book.

1.2 Surveys undertaken

1.2.1 This appendix contains the results of extensive archaeological surveys undertaken. Key surveys reported in this appendix include:

- LiDAR survey of the majority of the construction area;
- hyperspectral survey of the majority of the construction area; and
- geophysical surveys at 2 locations along the route (CN004 and CN006) encompassing 8.4 and 2.57 hectares respectively.

1.2.2 The results of aerial photographic analysis have been incorporated into the baseline report in Appendix CH-001-016 and are not reported separately for this CFA.

2 LiDAR and hyperspectral survey report

2.1 Introduction

2.1.1 The Ladbroke and Southam CFA extends from Wormleighton in the South to Bascote Heath in the North and comprises largely rural landscape, stretching for some 13 km on a broadly north west to south east alignment.

2.2 Methodology and limitations of analysis

LiDAR data

2.2.1 The filtered LiDAR data was used to create a Digital Terrain Model (DTM), and analysed in the GIS as three rasters comprising elevation data, a hillshade map and a slope map. Similarly, the unfiltered LiDAR data was used to create a Digital Surface Model (DSM) also analysed as elevation data, a hillshade map and a slope map.

2.2.2 Both the DTM and DSM were viewed as rasters in an ArcView GIS project. All identified features were digitised in the GIS from these rasters.

Hyperspectral data

2.2.3 The hyperspectral data was supplied as a series of ENVI DAT raster files, divided into 22 different sections (runs) covering the area of interest (CFA16-CFA22). Each ENVI DAT contained 34 bands, representing a portion of the electromagnetic spectrum which included visible light and the near-infrared range. The data had a horizontal cell resolution of 1m.

2.2.4 A number of ArcGIS 10's out-of-the-box tools were used to extract, process and analyse the data. Initially, the ENVI DAT files were imported into a mosaic dataset stored within an ArcGIS 10 file geodatabase. A single combined raster dataset, containing the 34 bands, was created from the mosaic dataset.

2.2.5 As no more than three bands can be viewed at once using ArcMap (the red, green and blue bands of the raster dataset) there is a requirement to investigate subsets of the hyperspectral dataset. Particular attention was paid to the near-infrared and the visible red parts of the electromagnetic spectrum, due to the recognised potential of these in helping to highlight archaeological features (Parcak 2009, 101-2). The near-infrared range (760nm to 900nm on the electromagnetic spectrum) covered bands 6 to 13 in the hyperspectral dataset. The visible red range (605nm to 690nm on the electromagnetic spectrum) covered bands 18 to 22 in the hyperspectral dataset.

2.2.6 The near-infrared and visible red bands were extracted from the combined raster dataset, allowing for these bands to be viewed in isolation. Principal Component Analysis was also carried out on these bands using ArcGIS 10's Principal Components tool. The extracted bands were used to generate a series of single output raster datasets for both the near near-infrared and visible red hyperspectral data; this included a single principal component layer dataset and a multiple principal component layer dataset for both ranges. Different principal component layers could then be assigned to the red, green and blue bands of the multiple principal component layers raster datasets.

Digitising

2.2.7 All feature identification was undertaken manually and compared to the results of available aerial photograph evidence. Both hyperspectral and LiDAR plots were examined in detail and features and areas of likely archaeological potential were digitised manually using ArcGIS 10. These features can be seen in Table 1 below. Archaeological features have been assigned a unique WA number, and are briefly described. Where possible broad dates have been suggested based on the form of the features, and the identification of the features has been assigned a confidence rating (based on a simple five point scale (Low, Low to Moderate, Moderate, Moderate to High and High). Where possible, similar features with a common distribution (e.g. former field boundaries or ponds within a coherent area) have been grouped together.

Limitations

2.2.8 The LiDAR data used in the study if this CFA was largely confined to the land required, temporarily or permanently, for the construction of the Proposed Scheme, with very little coverage of the wider 500m study area. As a result of this the majority of the sites identified lie within the land required, temporarily or permanently, for the construction of the Proposed Scheme. It should also be added that there were some areas where the LiDAR data provided did not extend across the entire area of the land required, temporarily or permanently, for the construction of the Proposed Scheme, notably to the east and north east of the village of Ufton, where two areas within the land required, temporarily or permanently, for the construction of the Proposed Scheme were not covered by the LiDAR data available.

2.2.9 Much of this stretch of the route is rural, and given over to farmland. Unfortunately, one result of this is that the DSM was less useful than expected as an interpretative tool, as the LiDAR seems to have been flown whilst the crops were fairly well developed. The main result of this is that these crops mask the underlying terrain on the DSM, reducing its effectiveness as an interpretative tool.

2.2.10 The DTM provides a model of the underlying terrain, stripping away crops and trees. As such it was particularly useful in allowing analysis of areas under crops, trees or woodland. However, even on the DTM, in some areas, low lying ground crops or piles or other obstructions have limited the effectiveness of the LiDAR, with the result that, in a few cases, the ground modelling is far from clear.

2.2.11 Unfortunately, the Hyperspectral data provided did not contain bands representing the mid-infrared range (approximately 8500nm to 13000nm on the electromagnetic spectrum). The mid-infrared range is regarded as holding particularly high potential when attempting to identify archaeological features; the Hyperspectral dataset contained no data beyond 992nm on the electromagnetic spectrum.

2.2.12 The horizontal cell resolution of the data also restricted the identification of smaller features (1m intervals) is also likely to have influenced the visibility of small archaeological features and lessened the clarity of some of the larger features.

2.2.13 The Hyperspectral data supplied covered virtually all of the land required, temporarily or permanently, for the construction of the Proposed Scheme and also covered the majority of the 500m study area. The overall coverage provided by the hyperspectral data is therefore excellent, although because of the number of variables affecting the visibility of features and

the limitations in the bandwidth recovered, it should be noted that the features already identified are likely to represent only a portion of those within the CFA.

2.2.14 The effectiveness of Hyperspectral data in identifying archaeology can be significantly influenced by a number of factors, including the nature of the underlying geology, the water content of the ground and the type of ground cover. Significant areas of the route studied lie within dense woodland, where there is no likelihood of features being recognised through analysis of Hyperspectral data, or beneath cereal crops, where the identification of features is likely to vary. It also suffers from the same limitations as the LiDAR data in built up areas. Because of these variations, other techniques used for identifying areas of archaeological potential (notably the Normalised Vegetation Data Index (NVDI) and the Water Band Index) were not examined in detail.

2.2.15 Despite these limitations, it is considered that the available LiDAR and Hyperspectral data provides comprehensive coverage of the land required, temporarily or permanently, for the construction of the Proposed Scheme as well as providing evidence for much of the surrounding 500m study area.

2.3 Results

2.3.1 A total of sixty four sites were identified on the various Hyperspectral and LiDAR plots within Community Forum Area 16. The bulk of these were identified on the LiDAR plots, with a smaller number also visible on the Hyperspectral imagery. Many appear on both. These are listed in Table 1 below.

2.3.2 In keeping with the rural nature of this stretch of the route, the majority of the archaeological sites identified comprise the remains of field boundaries, ponds, hollows (likely to either be infilled ponds or quarries) and occasional survivals of the characteristic earthworks created by 'ridge and furrow' agriculture. The latter developed through the ploughing regimes of the medieval and early post medieval periods, and can provide key evidence of the location and extent of medieval open field systems. Interestingly, there are a number of examples within this CFA where ridge and furrow earthworks are preserved within later woodland, such as in Berryhill Plantation near Wormleighton (WA16.8, see Figure 1) or in Ladbroke Fox Covert (WA16.30).

2.3.3 Combined with the evidence creation of larger fields through the removal of many of the earlier boundaries, this can tell us much about the development of the landscape through the medieval and post-medieval periods. Particularly extensive areas of ridge and furrow were noted in the vicinity of Lower Boddington and Wormleighton (WA16.1, WA16.2 and WA16.9, see Figure 2) and in the vicinity of Ladbroke Grove Farm (WA16.29, WA16.32 and 16.33) and to the east, south east and north east of Ladbroke (WA16.36 and WA16.37), whilst extensive areas were also noted to the south of Bascote Heath (WA16.56). Some areas of the ridge and furrow (WA16.56 and WA16.59) were clearly incorporated within the parkland at Ufton Wood upon its enclosure. These lie within the extent of the park pale, which can clearly be traced for much of its length (WA16.57). It is clear that the park was created later than the ridge and furrow, and enclosed at least some land which had previously been under arable (see Figure 3).

2.3.4 The numerous small streams and rivers within the area were clearly an important source of both power and resources throughout the medieval and post-medieval periods, being harnessed to drive watermills and to provide water for fishponds such as those at Chapel Bank Cottage (WA16.23 see Figure 4). There is some evidence within this CFA for the growing

industrialisation of the area in the late post-medieval and modern periods. In particular the route is crossed by the meandering route of the Oxford Canal (WA16.19), whilst the remains of brickworks were noted at Harp Farm (WA16.45).

2.3.5 The only other features of note recorded were a possible former trackway (WA16.60, see Figure 5) and the line of a former watercourse (WA16.50) South West of Southam, which may have been a focus for human activity in the past.

2.4 Summary

2.4.1 In general the sites identified are dominated by the remains of former field systems, including extensive areas of ridge and furrow, some later incorporated within woodland or parkland, former field boundaries and quarries/ponds, all likely to be linked to post-medieval and modern agriculture. There is clear evidence for the incorporation of agricultural land within the parkland at Ufton Wood. Small streams and rivers were used as a source of water and power feeding a watermills or fishponds, probably in the medieval, post-medieval and modern periods. There is some evidence for the later industrialisation of the area in the form of a stretch of the Oxford Canal, and in the presence of a later brickworks site. A former watercourse might also have acted as foci for human activity.

2.5 References

Parcak, S. H. (2009), *Satellite Remote Sensing for Archaeology*. Routledge, Abingdon.

2.6 Figures

Figure 1: Site WA16.8 Probable 'ridge and furrow' ploughing (pink) in Berryhill Plantation

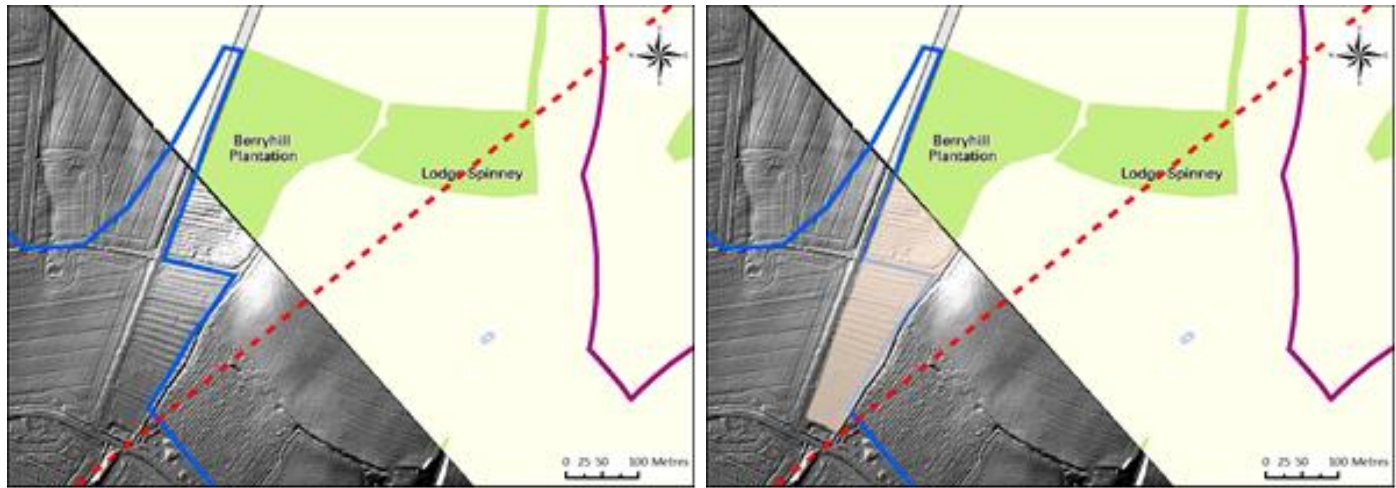


Figure 2: Site WA16.2. Probable 'ridge and furrow' ploughing (yellow) to the SW of Lower Boddington (Hyperspectral Band 6 – Wavelength 900.945nm)



Figure 3: Sites WA16.56 and WA16.57. Probable 'ridge and furrow' (beige) predating the establishment of the park at Upton Wood, the park pale of which is still evident (in red)

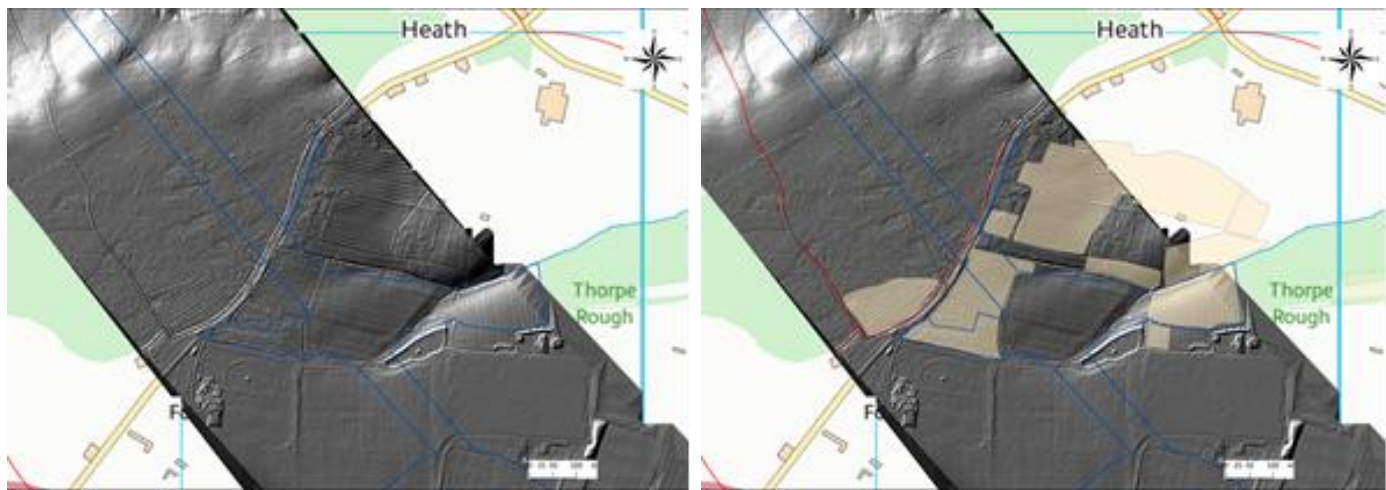


Figure 4: Sites WA16.23. Probable fishponds (orange) or millponds at Chapel Bank Cottage (Hyperspectral Band 10 – Wavelength 828.050 nm)

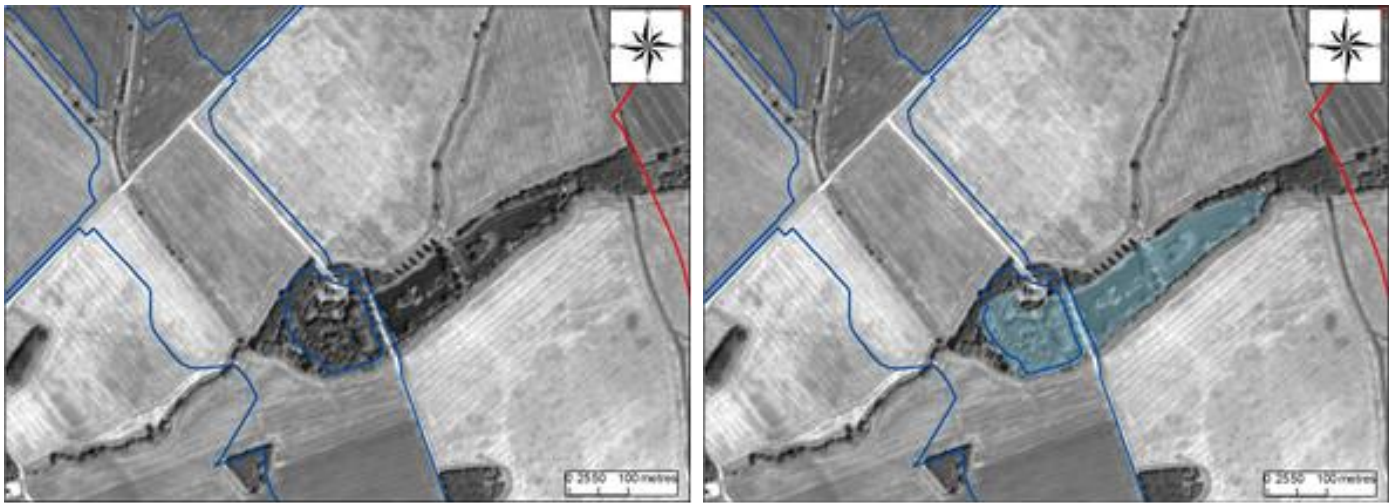


Figure 5: Site WA16.60. Parallel ditches (orange) to the N of Wood Farm – former trackway? (Hyperspectral Band 6 – Wavelength 900.945nm)

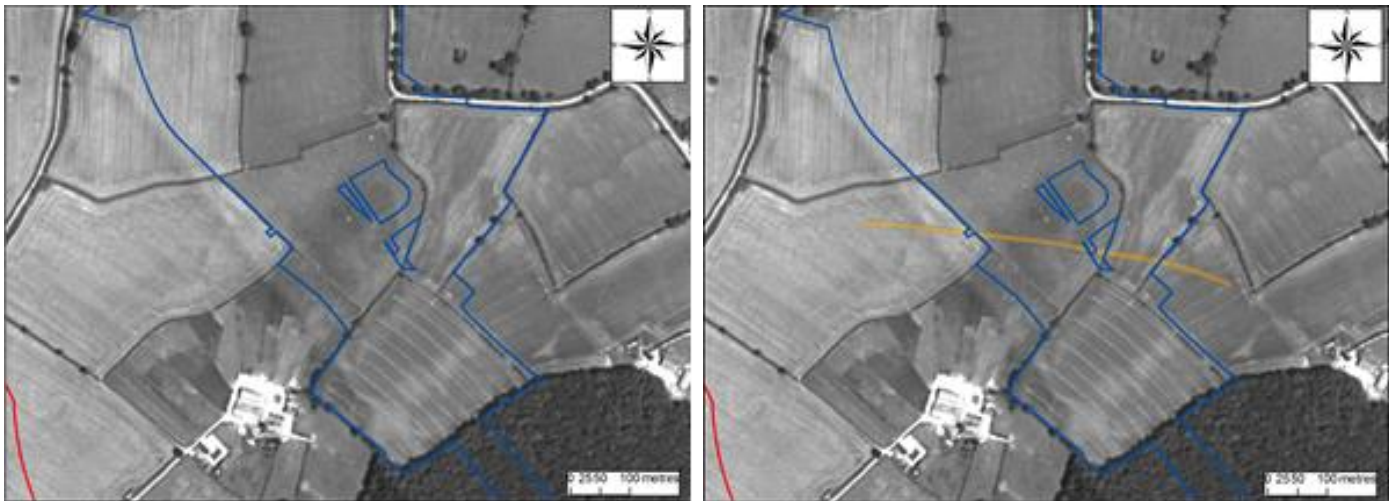


Figure 6: Anomalies within CFA16

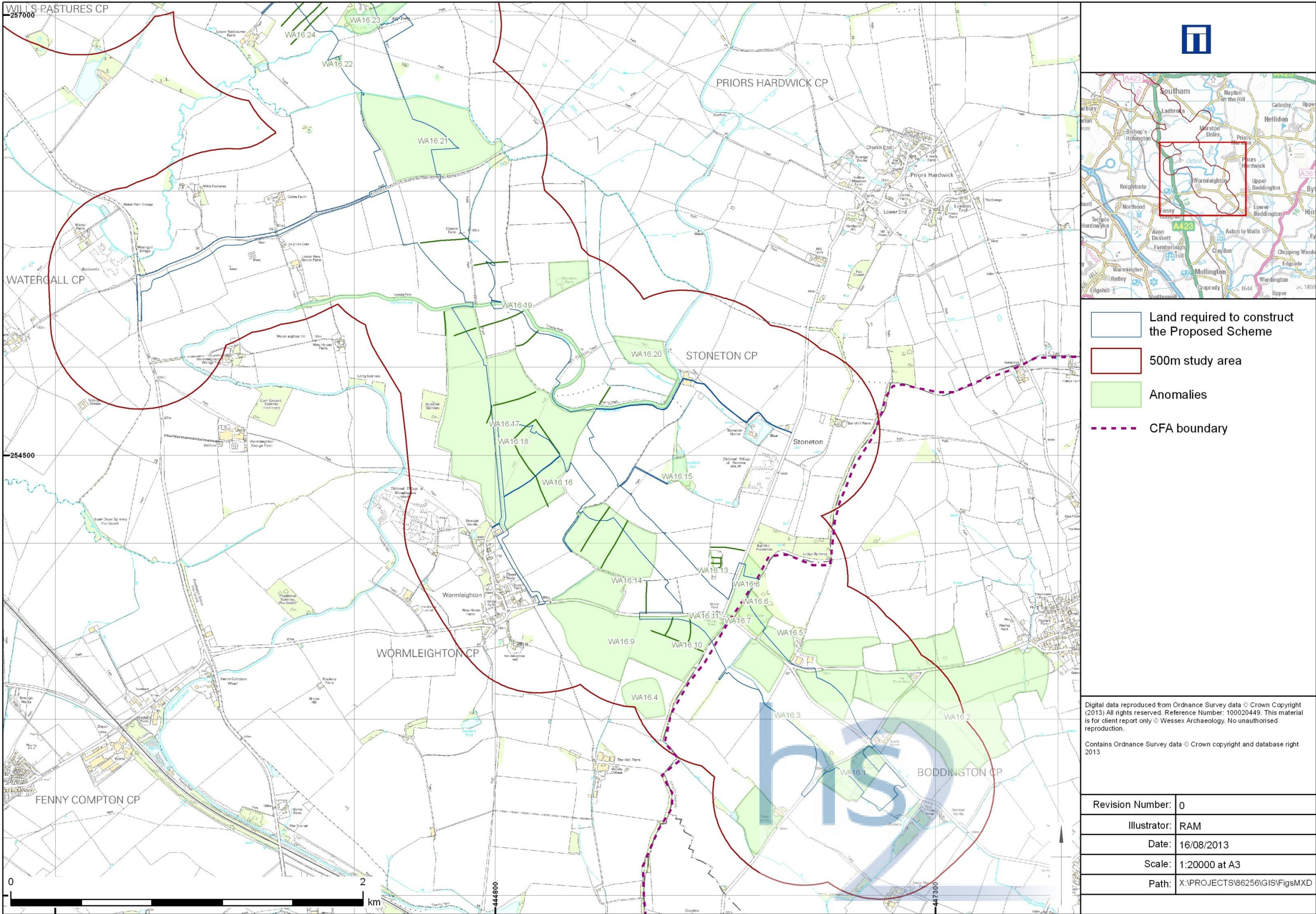


Figure 7: Anomalies within CFA16

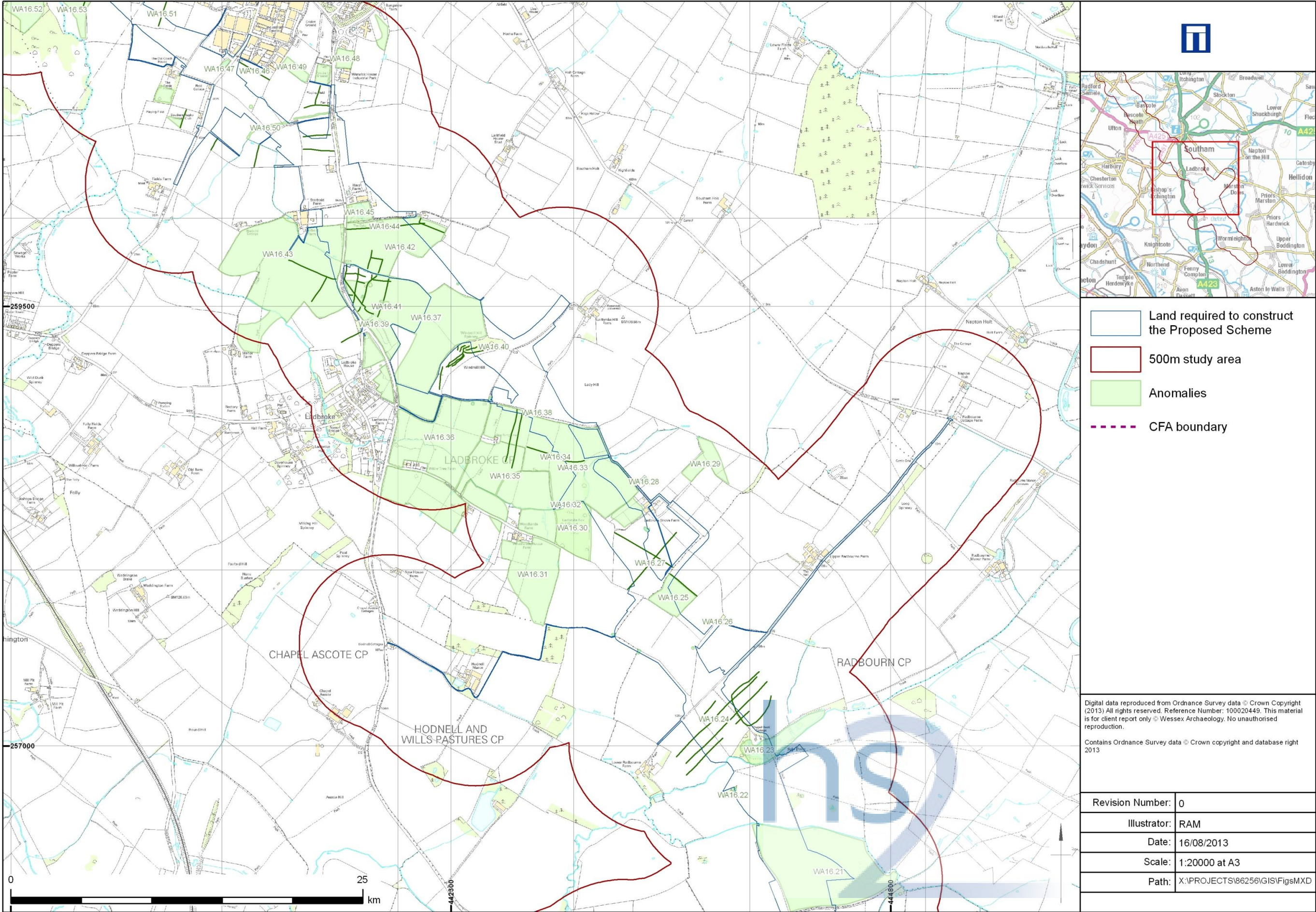
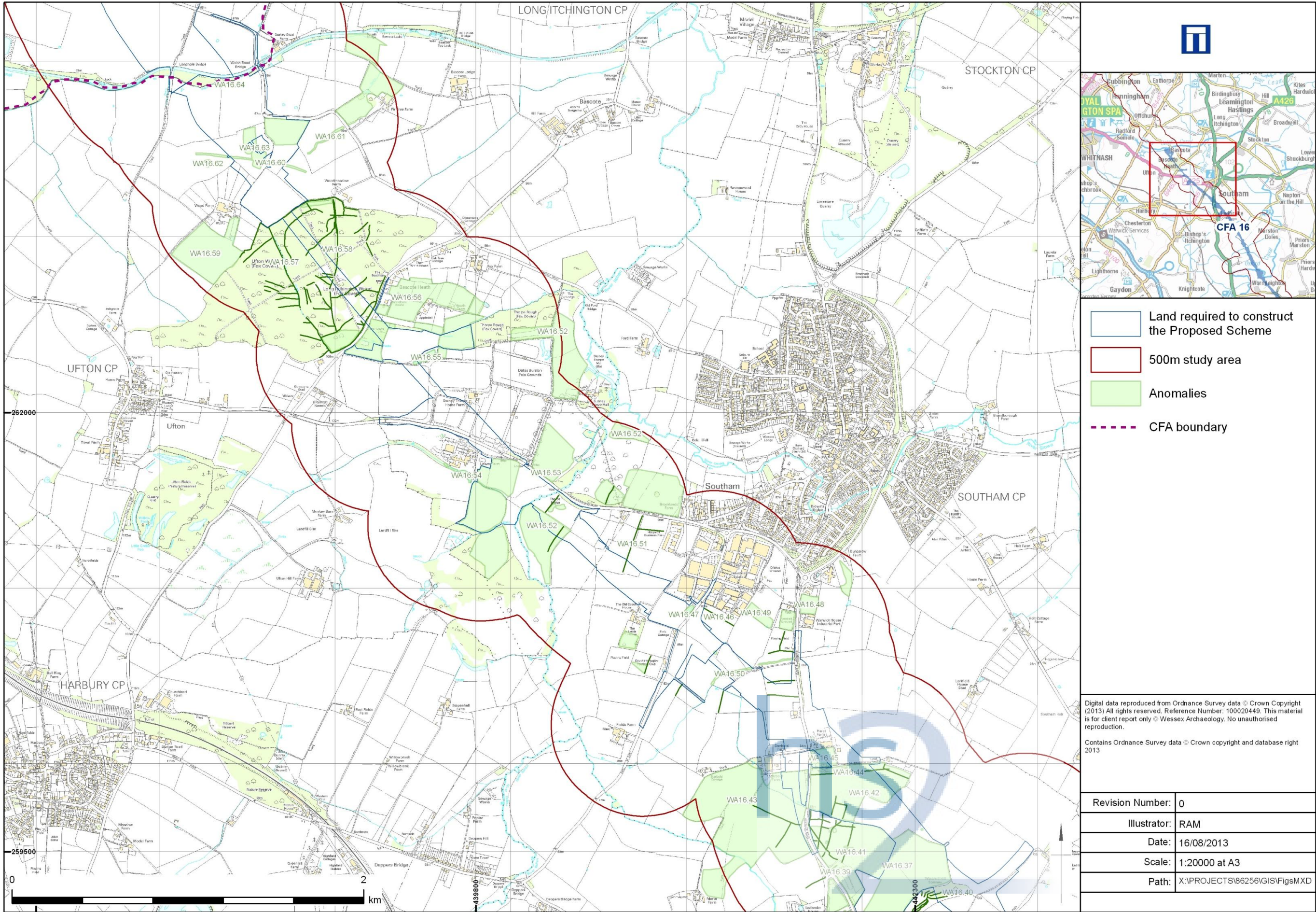


Figure 8: Anomalies within CFA16



2.7 Identified sites

Table 1: Sites within CFA16

No	CH-002-016 identifier	Site	Eastings	Northings	Description	Date	Confidence rating
WA16.1	Not in CFA16	W of Lower Boddington	446830	252650	Two areas of ridge and furrow fields evident on the Hyperspectral plots	Medieval/Post-medieval?	High
WA16.2	Not in CFA16	SW of Upper Boddington	447400	253100	Extensive areas of ridge and furrow fields visible to the SW of Lower Boddington – apparently aligned off two existing roads. Elements visible on both LiDAR and Hyperspectral data	Medieval/Post-medieval?	High
WA16.3	Not in CFA16	S of Fox Covert	446460	253020	Large irregular pond visible on LiDAR.	Post-medieval/Modern	High
WA16.4	LBS104	NE of The Hall Farm	445630	253100	Series of parallel linear anomalies – possibly drainage system. Not aligned on current field boundaries	Post-medieval/Modern	Moderate to High
WA16.5	Not in CFA16	E of Fox Covert	446475	253495	Irregular pond, now obscured by woodland	Post-medieval/Modern	High
WA16.6	Not in CFA16	Fox Covert	446280	253590	Furrows. On a NE-SW alignment and narrower than the adjacent ridge and furrow. Possibly plantation furrows? Evident on the LiDAR plots	Post-medieval/Modern	Moderate to High
WA16.7	Not in CFA16	SW of Fox Covert	446180	253565	3 interlinked irregular ponds partially within and to the SW of Fox Covert. Uncertain function. Evident on the LiDAR plots	Post-medieval/Modern	Moderate to High
WA16.8	LBS002	Berryhill Plantation and adjacent field	446220	253760	Ridge and furrow/plantation furrows within the plantation and in the field to the south west. Furrows on a NW – SE alignment. They appear to extend beyond the limits of the LiDAR data within the plantation	Post-medieval/Modern	Moderate to High
WA16.9	LBS002	E of Wormleighton	445400	253500	Extensive areas of ridge and furrow fields visible to the on either side of the road to Upper Boddington. Shows on Hyperspectral plot.	Medieval/Post-medieval?	Moderate to High
WA16.10	LBS002	E of Wormleighton	445790	253525	Series of former linear field boundaries on either side of road. Visible on LiDAR plot	Post-medieval/Modern	Moderate to High

No	CH-002-016 identifier	Site	Eastings	Northings	Description	Date	Confidence rating
WA16.11	modern feature – not included in CH-002-016	W of Fox Covert	445990	253585	Moderately large oval pond. Visible on LiDAR	Post-medieval/Modern	Moderate to High
WA16.12	modern feature – not included in CH-002-016	W of Fox Covert	446060	253890	Series of former field boundaries in rectangular field containing two buildings. Visible on LiDAR	Post-medieval/Modern	Moderate to High
WA16.13	LBS003	W of Fox Covert	446035	253890	Irregular linear hollow, probably the line of a former watercourse. Cannot be traced with confidence beyond the confines of the field. Visible on LiDAR	Undated	Moderate to High
WA16.14	modern feature – not included in CH-002-016	E of Wormleighton	445550	253790	Pair of ponds adjacent to each other in field boundary. Visible on LiDAR	Post-medieval/Modern	Moderate to High
WA16.15	modern feature – not included in CH-002-016	Newfield pool	445830	254385	Large pool/lake. Possibly a former millpond/fishpond? On both the LiDAR and Hyperspectral data	Undated	Moderate to High
WA16.16	modern feature – not included in CH-002-016	NE of Wormleighton	445150	254345	Two irregular ponds on the edge of the same field, visible on LiDAR	Post-medieval/Modern	Moderate to High
WA16.17	LBS105	NNE of Wormleighton	444850	254600	Extensive areas of ridge and furrow fields visible between Wormleighton and the Oxford Canal. Visible on Hyperspectral data	Medieval/Post-medieval?	Moderate to High
WA16.18	LBS105	NE of Windmill Spinney	444950	255130	Series of linear earthworks probably representing former field boundaries. Visible on LiDAR	Post-medieval/Modern	Moderate to High
WA16.19	LBS019	Oxford Canal	445000	255250	Long stretch of the Oxford canal crosses the LLAU	Post-medieval/Modern	High
WA16.20	LBS007	SE of Stoneton Farm	445650	255080	2 fields of ridge and furrows within the loop of the Oxford Canal. Visible on the Hyperspectral plot	Medieval/Post-medieval?	Moderate to High
WA16.21	LBS106	NW of Stoneton Farm	444430	256300	Large field containing linear anomalies. Many may be drainage features, but clear ridge and furrow at the eastern end of the field. Visible on the Hyperspectral plot.	Medieval/Post-medieval?	Moderate to High

No	CH-002-016 identifier	Site	Eastings	Northings	Description	Date	Confidence rating
WA16.22	modern feature – not included in CH-002-016	E of Lower Radbourne Farm	443910	256735	2 irregular ponds to the E of the farm visible on the LiDAR	Post-medieval/ Modern	Moderate to High
WA16.23	LBS034 and LBS035	Fishponds at Chapel bank cottage	444160	257020	Series of large interconnected fishponds. Visible on both Hyperspectral and LiDAR plots	Medieval/Post-medieval?	Moderate to High
WA16.24	LBS035	Lower Radbourne.	443660	257140	Sub oval enclosure to the north west of Chapel bank cottage and a series of linear earthworks aligned NE-SW, possibly former lynchets. Both extend beyond the area of the LiDAR data available	? Medieval	Moderate to High
WA16.25	LBS107	S of Ladbroke Grove Farm	443580	257820	Small field containing traces of ridge and furrow farming. Shown on the Hyperspectral data	Medieval/Post-medieval?	Moderate to High
WA16.26	modern feature – not included in CH-002-016	South of Ladbroke Grove Farm	443675	257555	Four ponds in fields to the south of the farm. All on modern field boundaries	Post-medieval/ Modern	Moderate to High
WA16.27	modern feature – not included in CH-002-016	South of Ladbroke Grove Farm	443465	258075	Linear earthworks representing the remains of former field boundaries in the large fields immediately to the south of the farm.	Post-medieval/ Modern	Moderate to High
WA16.28	modern feature – not included in CH-002-016	Ladbroke Grove Farm	443400	258500	2 ponds, one to the north and a second to the south of the farm	Post-medieval/ Modern	Moderate to High
WA16.29	LBS044	E and W of Ladbroke Grove Farm	443670	258550	Clear traces of ridge and furrow immediately to the west of the farm complex and in the fields to the east. Visible on both LiDAR and Hyperspectral data.	Medieval/Post-medieval?	Moderate to High
WA16.30	LBS046	Ladbroke Fox Covert	443000	258250	Well preserved area of former ridge and furrow now in woodland. Form and alignment of these suggests former ridge and furrow rather than plantation furrows. Visible on LiDAR	Medieval/Post-medieval?	Moderate to High
WA16.31	LBS046	In and around Woodlands House Farm	442790	258100	Extensive areas of ridge and furrow fields visible in the vicinity of Woodlands House Farm. Visible on the Hyperspectral data.	Medieval/Post-medieval?	Moderate to High

No	CH-002-016 identifier	Site	Eastings	Northings	Description	Date	Confidence rating
WA16.32	modern feature – not included in CH-002-016	NW of Ladbroke Grove Farm	442950	258370	3 ponds, all on modern field boundaries. Visible on LiDAR	Medieval/Post-medieval?	Moderate to High
WA16.33	LBS046 and LBS100	N of Ladbroke Grove Farm	442950	258650	Several fields bear remnant traces of earthworks suggestive of former ridge and furrow, predominantly on a NNE-SSW alignment. Visible on both LiDAR and Hyperspectral data.	Medieval/Post-medieval?	Moderate to High
WA16.34	LBS046 and LBS100	NW of Ladbroke Grove Farm	442890	258640	Substantial linear earthworks, probably former lynchets or field boundaries. Visible on LiDAR	Medieval/Post-medieval?	Moderate to High
WA16.35	LBS046	N of Woodlands House Farm	442610	258530	Wide linear feature, probably a boundary feature. Visible on Hyperspectral data.	Undated	Moderate to High
WA16.36	LBS046	E of Ladbroke	442100	258950	Extensive areas of ridge and furrow fields to the E of Ladbroke. Visible on both LiDAR and Hyperspectral data.	Medieval/Post-medieval?	High
WA16.37	LBS049 and LBS100	E and NE of Ladbroke	442090	259190	Extensive areas of ridge and furrow fields visible to the south east of Ladbroke. Visible on both LiDAR and Hyperspectral data.	Medieval/Post-medieval?	Moderate to High
WA16.38	modern feature – not included in CH-002-016	South of Windmill Hill	442520	258975	3 irregular ponds, all on the edges of modern fields. Visible on LiDAR.	Post-medieval/ Modern	Moderate to High
WA16.39	LBS049	NE of Ladbroke	441835	259395	Rectangular earthwork. Appears to comprise a 3 sided earthwork or bund. Visible on LiDAR.	Modern?	Low
WA16.40	LBS102	Windmill hill	442370	259210	Irregular linear features noted in the woods on windmill hill. Some may be natural in origin. Visible on LiDAR.	Undated	Low to Moderate
WA16.41	LBS049	NE of Ladbroke	441925	259505	3 hollows. One v large hollow apparently pre-dates the ridge and furrow. Former ponds/quarries? Visible on LiDAR.	Undated	Moderate
WA16.42	modern feature – not included in CH-002-016	NE of Ladbroke	441845	259620	4 ponds, 3 close to modern field boundaries. Visible on LiDAR.	Post-medieval/ Modern	Moderate to High

No	CH-002-016 identifier	Site	Eastings	Northings	Description	Date	Confidence rating
WA16.43	LBS049 and LBS100	S of Harp Farm	441900	259840	Extensive areas of remnant ridge and furrow. Less well preserved than that to the NE of Ladbroke. Predominantly on a NNE-SSW alignment. Visible on both LiDAR and Hyperspectral data.	Medieval/Post-medieval?	High
WA16.44	LBS049	N of Ladbroke	441815	259550	Linear earthworks likely to represent the remains of former field boundaries. Visible on LiDAR.	Medieval/Post-medieval/Modern	Moderate to High
WA16.45	LBS055	Harp Farm	441775	260030	Brickworks to south of Harp Farm. Visible on both LiDAR and Hyperspectral data.	Post-medieval/Modern	Moderate to High
WA16.46	modern feature – not included in CH-002-016	NW of Harp Farm	441180	260255	Series of linear earthworks likely to represent disused field boundaries. Visible on LiDAR.	Post-medieval/Modern	Moderate to High
WA16.47	modern feature – not included in CH-002-016	E and NE of Field Cottage	441010	260865	2 ponds. Located at edge of modern fields. Visible on LiDAR.	Post-medieval/Modern	Moderate to High
WA16.48	LBS108	South of Southam	441690	260900	Several small areas of ridge and furrow to the south of Southam. Visible on Hyperspectral data.	Medieval/Post-medieval?	Moderate to High
WA16.49	LBS108	SW of Southam	440745	260550	Small areas of ridge and furrow survive extant, although less well preserved in some areas than others. Visible on LiDAR.	Medieval/Post-medieval?	Moderate to High
WA16.50	natural feature – not included in CH-002-016	SW of Southam	441360	260540	Meandering linear anomaly, probably a former watercourse. Visible on LiDAR.	Undated	Moderate
WA16.51	modern feature – not included in CH-002-016	W of Southam	440685	261225	Series of linear earthworks likely to represent disused field boundaries. Visible on LiDAR.	Post-medieval/Modern	Moderate to High
WA16.52	LBS071 and LBS111	West of Southam	440150	261400	Several fields to the west of Southam bear the distinctive traces of ridge and furrow agriculture. Visible on both LiDAR and Hyperspectral data.	Medieval/Post-medieval?	Moderate to High
WA16.53	LBS068	W of Southam	440235	261455	Series of hollows on either side of the River Itchen, possibly the remains of quarries. Visible on LiDAR.	Undated	Moderate

No	CH-002-016 identifier	Site	Eastings	Northings	Description	Date	Confidence rating
WA16.54	modern feature – not included in CH-002-016	Lower Farm	439750	261640	Two ponds to the South of Lower Farm, the larger clearly dammed. Mill ponds/fishponds? Visible on LiDAR.	Post-medieval/Modern	Moderate
WA16.55	modern feature – not included in CH-002-016	S of Bascote Heath	439520	262315	Large irregular pond adjacent to stream. Visible on LiDAR.	Post-medieval/Modern	Moderate to High
WA16.56	LBS078	S of Bascote Heath	439400	262600	Extensive areas of former ridge and furrow fields. Particularly well preserved in the fields closest to the road and one well preserved area in woodland. Visible on both LiDAR and Hyperspectral data.	Medieval/Post-medieval?	High
WA16.57	LBS082	Long Itchington Wood/Ufton Wood	438900	262455	Substantial boundaries comprising banks with ditches on either side. Former park pales?	Medieval/Post-medieval?	Moderate to High
WA16.58	LBS082	Long Itchington Wood/Ufton Wood	439015	263000	Series of less substantial linear features, likely to represent former boundaries or drainage features	Medieval/Post-medieval?	Moderate to High
WA16.59	LBS110	SW of Wood Farm and SW of Woodmeadow Farm	438425	263055	Areas of ridge and furrow to the east and south east of the farms, including some within Ufton Wood. Extends beyond the limits of the LiDAR data	Medieval/Post-medieval?	Moderate to High
WA16.60	LBS109	N of Wood Farm	438620	263425	Parallel ditches appear to mark the line of an earlier road or track, possibly running to Woodmeadow Farm	Post-medieval/Modern	Moderate
WA16.61	modern feature – not included in CH-002-016	NE of Wood Farm	438950	263550	Winding sinuous linear anomaly, probably the line of a former watercourse	Undated	Moderate
WA16.62	modern feature – not included in CH-002-016	N of Wood Farm	438505	263495	Two large circular hollows. Possibly the remains of former quarries or ponds	Undated	Moderate
WA16.63	LBS112	N of Wood Farm	438540	263510	Traces of ridge and furrow to the north of the farm. At least 3 different plough regimes apparent	Medieval/Post-medieval?	Moderate to High

No	CH-002-016 identifier	Site	Eastings	Northings	Description	Date	Confidence rating
WA16.64	modern feature – not included in CH-002-016	SW of Burley Stud Farm	438400	263865	Pond close to stream	Post-medieval/ Modern	Moderate to High

3 Geophysical surveys

3.1 CN004 Land off Windmill Lane, near Ladbroke, Warwickshire

Introduction

Project background

3.1.1 Wessex Archaeology was commissioned by Atkins, on the behalf of HS2, to carry out a geophysical survey of area CN004 off Windmill Lane, near Ladbroke, Warwickshire (Figure 9), hereafter “the Site” (centred on NGR 442675 259100). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of HS2.

3.1.2 This Site, CN004, was selected for geophysical survey as it is located in an area of proposed major construction works. It is considered to be an area at medium/borderline high risk given its topographic location (risk model score: 3/2).

Site details

3.1.3 The Site comprises two arable fields located off Windmill Lane, southwest of Ladbroke Hill Farm. The Site lies approximately 1km northeast of the centre of Ladbroke and 11.5km southeast of Royal Leamington Spa. The limits of the geophysical survey area are defined by field boundaries for much of the area with the southern limits of the western field defined by the client. The Site comprises two fields; one was under stubble and the other was covered in long grass (possible fodder crop). Geophysical survey was undertaken over all fields with only a small area lost to obstructions. The area of data coverage came to around 8.4ha.

3.1.4 The Site lies on the southeast facing slope of a ridge of land aligned roughly southwest to northeast, this area of the ridge is named Windmill Hill. The northwest region of the survey area lies at a height a little over 120m aOD (above Ordnance Datum) and falls from this height to a little over 105m aOD at the southeast corner of the Site. The highest point in the local area is located near Ladbroke Hill Farm (138m aOD). There are no watercourses that flow close to the Site but an unnamed brook flows past the site to the south that flows into the River Itchen.

3.1.5 The solid geology is recorded as lower lias (Jurassic) (Ordnance Survey 1957). There are no superficial deposits recorded on Site or close to it (Ordnance Survey 1977). The soils underlying the Site are likely to be pelo-stagnogley soils of the 712b (Denchworth) association (SSEW 1983). Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

Archaeological background

3.1.6 There are no records of archaeological sites located within the survey area. There is one site which is close which is a possible windmill dating to at least the post-medieval period. The name of the hill and documentary evidence suggests it is possibly located to the west of the survey area (MWA933). Another feature linked to windmills is a mound to the immediate southeast of Ladbroke; the feature is marked on maps and is considered to be a windmill mound (MWA932).

3.1.7 The majority of records are to be found close to Ladbroke. Medieval earthworks, visible on aerial photographs, towards the north of the village were excavated. The excavation showed

that part of the area was enclosed in the medieval although no evidence of occupation was found (MWA6920 and MWA7263). Further north are more earthworks including ponds although their function is not clear. There are two areas of extant ridge and furrow located to the southeast of the site that are shown on modern aerial photographs; this is thought to date to either the medieval or post-medieval (MWA12890). There is ridge and furrow further north that is no longer visible (EH1532584 and EH1532614). The site of a brickworks lies to the northwest that is considered to be in use during the imperial period (MWA3872).

Methodology

Survey objectives

3.1.8 A Written Scheme of Investigation (WSI) was prepared by Wessex Archaeology which outlined the aims of the survey and the proposed methodology to be followed (Wessex Archaeology 2013). The stated aims include the following:

- to conduct a detailed survey which covers as much of the specified area as possible, allowing for artificial obstructions;
- to clarify the presence/absence and extent of any buried archaeological remains within the site; and
- to determine the general nature of the remains present.

3.1.9 This report presents a brief description of the methodology followed, the detailed survey results and the archaeological interpretation of the geophysical data.

Survey dates

3.1.10 A detailed gradiometer survey was carried out by Wessex Archaeology's in-house geophysics team between 17th and 19th June 2013.

Grid location

3.1.11 The individual survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS instrument, which is precise to approximately 0.02m and therefore exceeds English Heritage recommendations (EH 2008).

3.1.12 A representative sample of survey grid nodes (around 10%) were re-surveyed in the mornings in the event they were left out in the field overnight. This was undertaken along with a visual inspection of entire lines of grid nodes to ensure the survey grid remained accurate for the entire survey.

Instruments used and survey method

3.1.13 The magnetometer survey was conducted using a Bartington Grad601-2 fluxgate gradiometer instrument, which has a vertical separation of 1m between sensors. Data were collected at 0.25m intervals along transects spaced 1m apart with an effective sensitivity of 0.03nT, in accordance with EH guidelines (EH 2008).

3.1.14 Data were collected in the zigzag method with grids oriented north to south (Grid North). The first direction walked for each grid was heading towards the north.

Data processing

3.1.15 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse (ZMT) function ($\pm 7nT$ thresholds for most grids) applied to correct for any

- variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. The multiply function was applied to selected grids to balance out differences in background texture that resulted from collecting some grids at different heights to others. The deslope function was used to correct errors that resulted from imperfections in the ZMT function. These four steps were applied to all survey data, with no interpolation applied.
- 3.1.16 Further details of the geophysical and survey equipment, methods and processing are described in Appendix 1.
- Data presentation*
- 3.1.17 The processed gradiometer data were output as .png image files and georeferenced in CAD (AutoCAD Map 3D 2011); these images were exported as georeferenced .png image files (accompanied by .pgw files). The interpretation layers were digitised in CAD and the resulting interpretation layers were exported as ESRI shapefiles, in accordance with the specification. The data images and interpretation shapefiles were then passed to our graphics team who produced the final figures in GIS (ESRI ArcMap 10).
- 3.1.18 The gradiometer data are displayed at -2nT (white) to +3nT (black) for the greyscale image and $\pm 25\text{nT}$ at 25nT per cm for the XY trace plots. The XY trace plot images have been produced at a scale of 1:1500.
- Results**
- Introduction*
- 3.1.19 The gradiometer survey has been successful in identifying anomalies of likely and possible archaeological interest, along with numerous trends and one modern service. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:1500 (Figures 9 to 12).
- 3.1.20 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (Figure 12). Full definitions of the interpretation terms used in this report are provided in Appendix 2.
- 3.1.21 Numerous ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.
- Interpretation: archaeology*
- 3.1.22 The greatest concentration of archaeological features lies in the south eastern corner of the Site. They appear to form a dense group of rectangular enclosures set on two differing alignments. The enclosures at 4000 to 4002, to the south, are aligned WNW to ESE whereas the enclosures further north, at 4003 to 4007, are aligned northwest to southeast. The archaeology in this field is very weak, less than +1nT in some instances, and in places gradually fades into the background. There is scope for more features to exist on Site than were detected in this survey. All archaeological features in this area have been divided into different archaeological categories according to their archaeological potential and the strength of response. The weak response anomalies tend to measure less than +2nT and the stronger anomalies measure more than +2nT.
- 3.1.23 There is a rectangular enclosure at 4000; three sides are defined clearly but the fourth side is defined by a very weak trend. The enclosure measures 17.5m x 13.5m and is associated with a spread of increased magnetic response. Two more enclosures lie immediately to the north near 4001; the smaller of the two (15.5m x 8.6m) lies to the south and a longer narrow one (16.5m x 8m) is located north of this. The northern enclosure has two weak offshoot ditches that extend out to the WNW and appear to terminate around 4002. It is not clear whether the ditches terminate here or fade out due to a loss in magnetic contrast. This loss in contrast could be due to the composition of the ditch fills that may contain less magnetised anthropogenic material the further from the denser areas of activity. To the west of the southern enclosure of the two at 4001 are a group of weak trends of uncertain origin; given their arrangement it is possible that some of these may prove to be archaeological.
- 3.1.24 This group of enclosures is associated with other small weak anomalies (less than +2nT) that may represent anything from short sections of ditch to pits and postholes. The most interesting of these anomalies lies to the south of 4001 and is a sub-rectangular shaped positive anomaly that appears to join up with a ditch. It has weak magnetic values, less than +2nT, and is considered to be archaeological, perhaps representing a pit. There are stronger, smaller positive anomalies in the area; some may represent strongly magnetised archaeological features whereas others may represent data spikes or ferrous responses.
- 3.1.25 These enclosures are considered to be archaeological but their function is unclear. They could either represent areas of settlement or could be animal enclosures located close to a nearby agricultural settlement.
- 3.1.26 To the north of this complex is another very similar arrangement, albeit set at a different alignment. There is a group of parallel linear positive anomalies at 4003 that define the southern extent of this second group of enclosures; in all there are four closely spaced parallel linear ditches with varying strengths in magnetic response. It is not clear if they are all contemporary but only two of them appear to extend further out towards the northwest forming a narrow corridor 9m in width. These extensions fade out further from the main area of activity with either very weak anomalies (4004) or weak trends (4005) defining them.
- 3.1.27 To the north of these ditches are at least two enclosures. The example west of 4006 has only three sides visible and measures 11m in width and at least 18m in length. The enclosure west of 4007 also has only three sides visible and measures 11.7m in width and at least 17.8m in length. Inside both of the enclosures are short perpendicular extensions coming off the ditches that may suggest further sub-division of these areas. A trend of uncertain origin within 4006 may prove to be such a sub-division.
- 3.1.28 There are a number of smaller anomalies in the vicinity of these enclosures; some of these may prove to be cut features related to the enclosures such as pits and postholes. Two of these anomalies are quite regular in form and arrangement such as the curved ditch-like anomaly southwest of 4006 and the anomalies at 4008 that may form a short section of ditch. These features have very weak values and have been termed possible archaeology (weak response) to reflect this.
- 3.1.29 These enclosures seem to have the same form and therefore possibly have the same function as the enclosures further south. It is not clear if the difference in the alignment indicates that they are of different phases but they do not seem to overlap one another which would usually be a clear sign that there are two phases of occupation.

- 3.1.30 The rest of the site is relatively quiet in contrast to the south eastern corner. The dominant anomalies visible are a number of ceramic field drains that criss-cross the site as can be seen around 4009 and 4016. The drains are characterised by a repeating pattern of positive and negative bipolar responses that can be very weak in places. There is an area of increased magnetic response around 4010; this may be an area of plough damaged field drains as the strength in response is similar to that of the intact field drains.
- 3.1.31 There are more regularly spaced linear features around 4011 that are clearly not ceramic field drains. They appear as both negative and positive trends aligned parallel to one another and have been interpreted as ridge and furrow. They may also prove to be the remains of earthworks created to act as drains or may be remnants of potato growing in this field. Other trends that are thought to be created by ploughing scars are present around 4015 and 4016.
- 3.1.32 The remaining trends visible on site are linear and curvilinear trends of uncertain origin. Some examples may prove to be ploughing scars but others such as those at 4012, 4013 and 4014 may prove to be more significant given their forms.
- 3.1.33 There are numerous small positive anomalies spread throughout the data; some are very small with stronger positive values (over +2nT) and others are slightly larger with weaker values. These anomalies have been classed as possible archaeology and have been divided according to the strength of their response. As there is no significant patterning in their spatial distribution it is not possible to further assess their archaeological potential from the geophysical data alone.

Interpretation: modern services

- 3.1.34 One modern service has been identified in the data at 4007; this service appears to be a metallic/ceramic pipe that is running along the easternmost field boundary. It appears to be incomplete and broken up in the data but this could be an effect of the data processing rather than the physical state of the pipe.
- 3.1.35 It is not clear from the geophysical data whether the services identified are in active use or not. Also gradiometer data will not be able to locate and identify all services present on site. This report and accompanying illustrations should not be used as the sole source for service locations and appropriate equipment (e.g. CAT and Genny) should be used to confirm the location of buried services before any trenches are opened on site.

Conclusions

Introduction

- 3.1.36 The detailed gradiometer survey has been successful in detecting anomalies of likely and possible archaeological interest within the Site, in addition to regions of increased magnetic response, numerous trends of uncertain origin and at least one modern service.

Discussion

- 3.1.37 The data shows a number of archaeological features that do not appear to be recorded. Only the edge of the complex is visible in the data with the rest extending further east and south outside of the survey area. It is not clear whether the small enclosures had an agricultural or a domestic function but the complex is clearly of archaeological interest. It is not possible to date archaeological features from geophysical data but given its rectilinear form it is unlikely to be an early prehistoric site.

- 3.1.38 Anomalies appear to fade out in the data towards the northwest. It may be that this loss of contrast is simply due to the ditches running away from the settlement area and are therefore not filling with as much anthropogenic material. Another possibility is that alluvial build-up is greater towards the northwest where the relief is a little steeper. In that case archaeological features may gradually run deeper down towards the northwest to a depth where they are no longer detectable with a fluxgate gradiometer.
- 3.1.39 The relative dimensions of the modern services identified by the gradiometer survey are indicative of the strength of their magnetic response, which is dependent upon the materials used in their construction and the backfill of the service trenches. The physical dimensions of the services indicated may therefore differ from their magnetic extents in plan; it is assumed that the centreline of services is coincident with the centreline of their anomalies. It is difficult to estimate the depth of burial of the services through gradiometer survey.
- 3.1.40 6.2.4 It should be noted that small, weakly magnetised features may produce responses that are below the detection threshold of magnetometers. It may therefore be the case that more archaeological features may be encountered than have been identified through geophysical survey. Given how weak many of the features interpreted in this data are it seems very likely that more features may be present than were detected during the survey.

References

Bibliography

English Heritage (2008), *Geophysical Survey in Archaeological Field Evaluation*. Research and Professional Service Guideline No. 1, 2nd Edition.

Soil Survey of England and Wales (1983), Sheet 3, Soils of Midland and Western England. Ordnance Survey: Southampton.

Ordnance Survey (1977), Quaternary Map of the United Kingdom: South. Ordnance Survey: Southampton.

Ordnance Survey (1957), Sheet 2, Geological Map of Great Britain: England and Wales. Ordnance Survey: Chessington.

Wessex Archaeology (2013), *HS2: Geophysical Survey Written Scheme of Investigation*. Report Reference: 86254.01.

HER records consulted

MWA930 – ponds to E of Ladbroke House

MWA932 – possible windmill mound 400m NW of Bell Farm

MWA933 – site of possible windmill on Windmill Hill

MWA3872 – brickworks 300m E of Starbold Farm

MWA6920 – possible medieval settlement earthworks in Ladbroke

MWA7263 – evaluation at Windmill Lane

MWA12890 – ridge and furrow near Ladbroke Grove Farm

English Heritage PastScape records

Monument No. 1532584 – dispersed ridge and furrow (EH1532584)

Monument No. 1532614 – dispersed ridge and furrow (EH1532614)

Figures

Figure 9: Site location

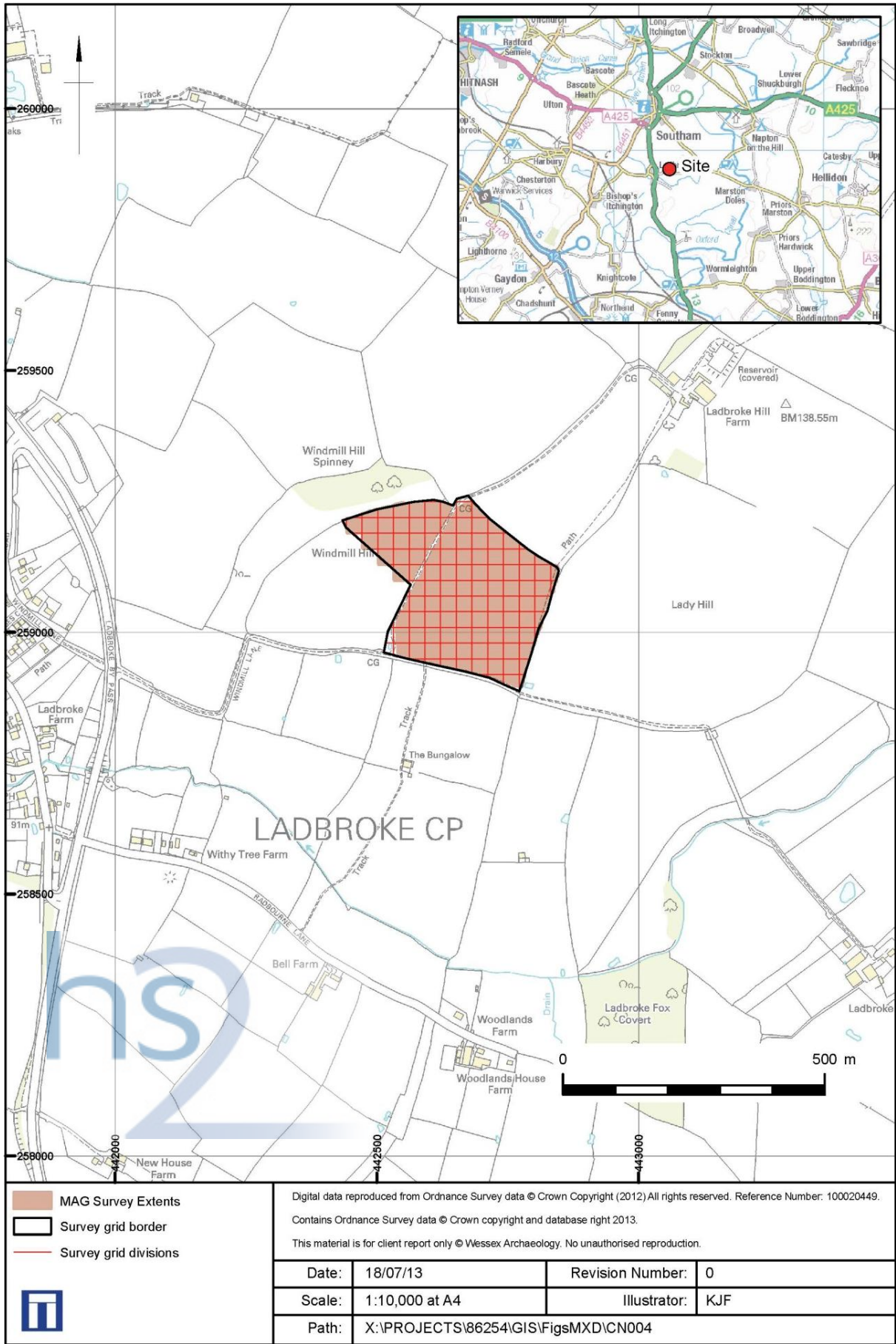




Figure 11: XY trace

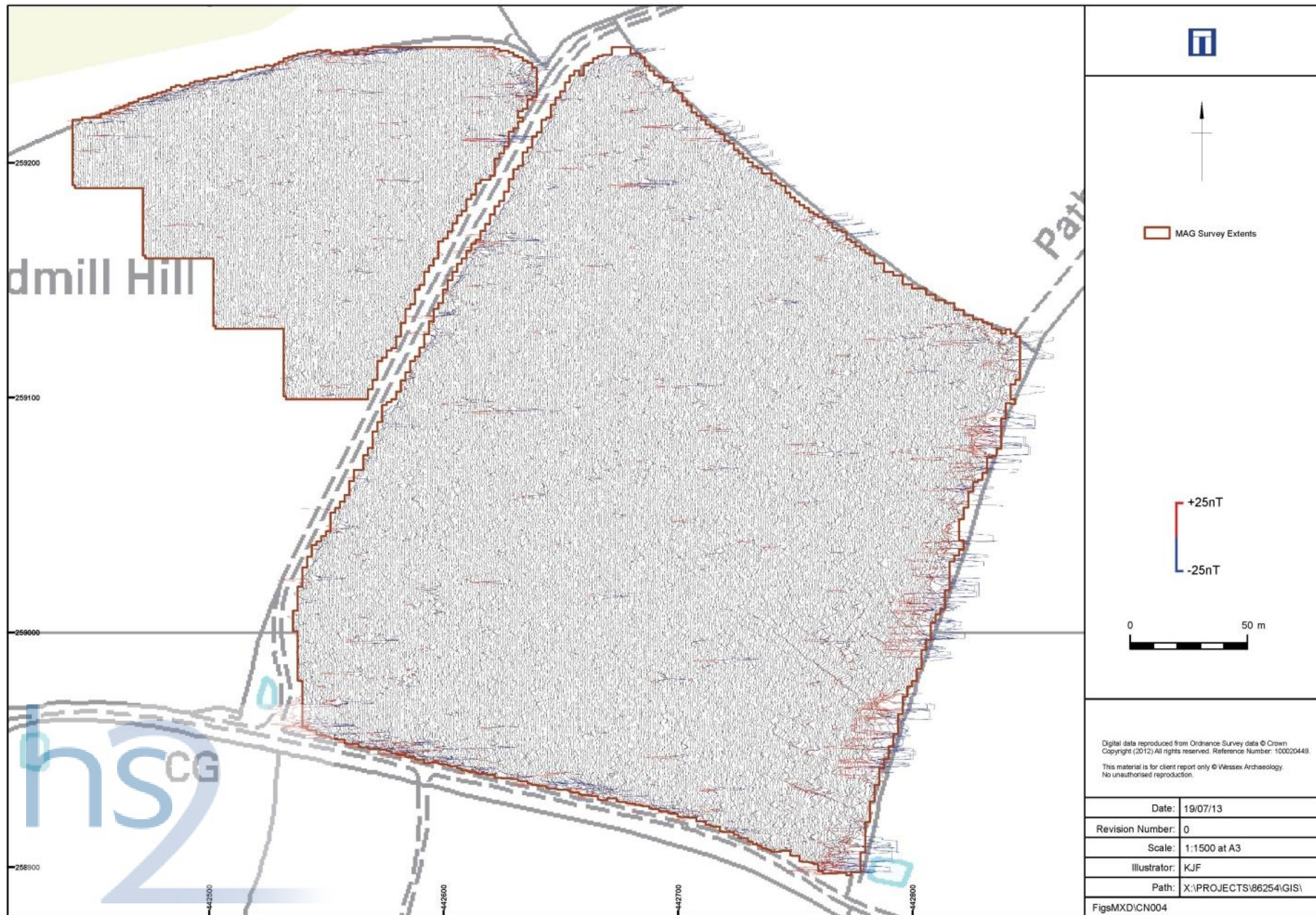


Figure 12: Interpretation



3.2 CNoo6 Land off Welsh Road, near Ufton, Warwickshire

Introduction

Project background

3.2.1 Wessex Archaeology was commissioned by Atkins, on the behalf of HS2, to carry out a geophysical survey of area CNoo6 off Welsh Road, near the village of Ufton, Warwickshire (Figure 13), hereafter “the Site” (centred on NGR 438727 263274). The Site lies to the south of a section of the Grand Union Canal. The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of HS2.

3.2.2 This Site, CNoo6, was selected for geophysical survey as it is located within an area dominated by medieval settlement features and has the potential to detect archaeological remains associated with the deserted medieval settlement to the east of the village of Ufton.

Site details

3.2.3 The Site comprises three fields located off Welsh Road and it lies approximately 1.5km north-east of the village of Ufton. The limits of the geophysical survey area are defined by modern field boundaries for much of the area with the southern limits defined by the client. To the north of the survey area is a road and to the south is Long Itchington Wood. The Site comprises three fields recently ploughed. Geophysical survey was undertaken over the field with a significant area still to be surveyed due to recent deep ploughing making the ground unsurveyable. This document is reporting on the 2.57 ha which have been completed so far out of the original 14.8ha which were due to be surveyed.

3.2.4 The Site lies on an area of gently sloping land that falls away towards the northeast. The southern region of the survey area lies at a height a little over 80m aOD (above Ordnance Datum) and falls from this height to less than 70m aOD at the northwest corner of the Site.

3.2.5 The solid geology is recorded as Lower Lias formation, a Lower Jurassic sedimentary rock (Ordnance Survey 1957) with superficial deposits of Boulder Clay and Morainic Drift recorded in the surrounding area therefore with the possibility that there are localised deposits on the Site (Quaternary) (Ordnance Survey 1977).

3.2.6 The soils underlying the majority of the Site are likely to be pelo-stagnogley soils of the 712b (Denchworth) association with deposits of typical argillic pelosols of the 431 (Worcester) association to the north and to the south typical calcareous pelosols of the 411a (Evesham 1) association (SSEW SE Sheet 3-2 1983). Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

Archaeological background

3.2.7 For a detailed assessment of the known archaeology of the Site and surrounding area the relevant DBA should be consulted. A summary of the available archaeological records within 1km radius of the Site centre point has been provided here for reference with the results and interpretation of the geophysical survey.

3.2.8 In summary recorded features and sites in the area are predominantly of medieval, post medieval and 20th century date and relate to agricultural activity, industrial activity probably on a localised scale and the Second World War defensive structures of the Grand Union Canal. In the wider area beyond the arbitrary radius of 1km and the nearest villages of Ufton and Long

Itchington are recorded sites and findspots of Neolithic, Bronze Age, Roman, and Anglo-Saxon/early medieval date. The concentration of medieval records with some dating to early medieval and with the possibility of Saxon sites in the area as well suggests that the origins of the medieval settlements could be even earlier.

3.2.9 The village of Ufton to the south-west of the Site was a medieval settlement (MWA9538) with remains of buildings and ridge and furrow recorded 500m south of the church at Ufton (MWA7542) and with a possible deserted medieval settlement 200m south-west of the church at Ufton (MWA6224). This potentially indicates that the medieval settlement was covering a larger area than the current modern settlement. The Site lies between two medieval settlements at Ufton to the south-west and Long Itchington to the north-east and several of the records in and around the Site relate to medieval activity, particularly agricultural activity as demonstrated by the presence of ridge and furrow.

3.2.10 Within the survey area itself are recorded two possible enclosures (MWA6788), of unknown date, which are visible as cropmarks on aerial photographs. They are located 200m north of Ufton Wood.

3.2.11 Bordering the southern boundary of the Site is an area of woodland which is the site of the parish boundary between Ufton Wood and Long Itchington Wood dating to the early medieval period. An ancient charter boundary relating to Long Itchington records it at this location (MWA8889) with the possibility of an earthen bank delimiting the parish boundary.

3.2.12 To the west of the Site are two features, both recorded as probably medieval or post-medieval mounds or spoil heaps. One is visible as a cropmark on aerial photographs taken in 1945 and 1996, though it appears to be in the process of being removed on aerial photographs taken in 2006. The site comprises a circular mound (PastScape ID 1528220). The second site comprises a sub-circular mound which measures 37m in diameter. The site superficially resembles a ploughed out round barrow, but it appears to be on the top of ridge and furrow (PastScape ID 1528249).

3.2.13 Approximately 500m to the east is a partly dispersed, partly contiguous area of medieval or post-medieval ridge and furrow is visible as earthworks on photographs taken in the 1940s, though about two thirds of it has been levelled on aerial photographs taken in the 1990s (PastScape ID 1528168). There is a second record of a partly dispersed, partly contiguous area of medieval or post-medieval ridge and furrow approximately 750m to the south-west of the Site bordering on Ufton Wood (PastScape ID 1531887).

3.2.14 To the south-west of the Site between Ufton Wood and the outskirts of Ufton are three locations of industrial activity all dating to the Imperial period of mid-18th century to early 20th century. Approximately 400m NW of Ufton Church documentary evidence suggests that this is the site of a brick kiln used for making bricks during the Imperial period (MWA827). A lime kiln 800N of Ufton Church, with documentary evidence suggesting that this is the site of a lime kiln dating to the Imperial period and there is extensive evidence of quarrying within the field between here and the church at Ufton (MWA828). Thirdly brickworks at Brickyard Cottage where bricks were made during the Imperial period. They are marked on the Ordnance Survey map of 1885, and were located 300m northwest of the church at Ufton (MWA7090).

3.2.15 The Grand Union Canal runs approximately 300m to the north of the Site and there are various records associated with it such as a double lock (MWA4304) at Bascote Locks, a toll house

(MWA4319), and a second world war anti-tank road block (MWA8097) and pillbox located on the bank of the south side of the Grand Union Canal near Bascote, adjacent to Longhole Bridge (PastScape ID 1417804).

Methodology

Survey objectives

3.2.16 A Written Scheme of Investigation (WSI) was prepared by Wessex Archaeology which outlined the aims of the survey and the proposed methodology to be followed (Wessex Archaeology 2013). The stated aims include the following:

- to conduct a detailed survey which covers as much of the specified area as possible, allowing for artificial obstructions;
- to clarify the presence/absence and extent of any buried archaeological remains within the site; and
- to determine the general nature of the remains present.

3.2.17 This report presents a brief description of the methodology followed, the detailed survey results and the archaeological interpretation of the geophysical data.

Survey dates

3.2.18 A detailed gradiometer survey was carried out by Wessex Archaeology's in-house geophysics team on 24-27 June 2013.

Grid location

3.2.19 The individual survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS instrument, which is precise to approximately 0.02m and therefore exceeds English Heritage recommendations (EH 2008).

3.2.20 A representative sample of survey grid nodes (around 10%) were re-surveyed in the mornings in the event they were left out in the field overnight. This was undertaken along with a visual inspection of entire lines of grid nodes to ensure the survey grid remained accurate for the entire survey.

Instruments used and survey method

3.2.21 The magnetometer survey was conducted using a Bartington Grad601-2 fluxgate gradiometer instrument, which has a vertical separation of 1m between sensors. Data were collected at 0.25m intervals along transects spaced 1m apart with an effective sensitivity of 0.03nT, in accordance with EH guidelines (EH 2008).

3.2.22 Data were collected in the zigzag method with grids oriented north to south (Grid North). The first direction walked for each grid was heading towards the north.

Data processing

3.2.23 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse (ZMT) function (± 7 nT thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. These two steps were applied to all survey data, with no interpolation applied.

3.2.24 Further details of the geophysical and survey equipment, methods and processing are described in Appendix 1.

Data Presentation

3.2.25 The processed gradiometer data were output as .png image files and georeferenced in CAD (AutoCAD Map 3D 2011); these images were exported as georeferenced .png image files (accompanied by .pgw files). The interpretation layers were digitised in CAD and the resulting interpretation layers were exported as ESRI shapefiles, in accordance with the specification. The data images and interpretation shapefiles were then passed to our graphics team who produced the final figures in GIS (ESRI ArcMap 10).

3.2.26 The gradiometer data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ± 25 nT at 25nT per cm for the XY trace plots. The XY trace plot images have been produced at a scale of 1:1000.

Results

Introduction

3.2.27 The gradiometer survey has been successful in identifying anomalies of likely and possible archaeological interest, along with numerous trends. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:1000 (Figures 13 to 16).

3.2.28 The interpretation of the dataset highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (Figure 16). Full definitions of the interpretation terms used in this report are provided in Appendix 2.

3.2.29 Numerous ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

3.2.30 No modern services have been detected in the area of this Site surveyed so far and there is a ceramic field drain running across the south-east corner of the Site (Anomaly 4008) which is discussed in further detail below.

Interpretation: archaeology

3.2.31 An irregular shaped but roughly oval area at 4000 has been identified as a positive magnetic anomaly and interpreted as archaeology, it is possibly a cut feature such as a pit. There is a ferrous anomaly within the positive anomaly but as there are numerous ferrous anomalies across this area it is probably more likely to be related to these and possibly modern debris rather than being part of the cut feature.

3.2.32 To the north-west of 4000 are several oval and sub-oval weakly positive anomalies and one linear section of weakly positive magnetic anomaly. They are interpreted as archaeology (weak response) and could represent cut features such as pits, with the linear anomaly possibly a surviving section of ditch. They do not form a regular pattern or distribution.

3.2.33 A short L-shaped section of weakly positive magnetic anomaly at 4001 lies approximately 15-20m south of the anomaly at 4000 interpreted as archaeology. It is possibly archaeological in origin and a cut feature but due to its weak magnetic values along its length it is a tentative interpretation.

- 3.2.34 A linear positive anomaly at 4002, orientated north-west to south-east and having a weak magnetic value has interpreted as archaeology (weak response) due to its regular linear shape and weak positive response. It is not contiguous with any other anomaly immediately nearby but a weak positive linear has been identified at 4003. It is at right angles to the anomaly at 4002 and could be associated, possibly forming a large cut feature such as a ditched enclosure but this is tentative due to the weak magnetic contrast between the features and the subsoil.
- 3.2.35 Further to the intermittent linear anomaly at 4003 (described above in association with 4002) are three separate roughly linear/curvilinear weak positive anomalies to the east of 4003. They are similar in response to the anomalies at 4001 and at 4003 and have been interpreted as archaeology (weak response). They could represent cut features such as a ditch but their association with each other is unknown. The anomalies do not form a regular pattern such as forming an enclosure which could relate them to each other. Surrounding the linear/curvilinear anomalies are numerous linear and curvilinear trends of uncertain origin. They criss-cross each other and do not form a regular distribution or pattern.
- 3.2.36 At 4004 is a rectilinear weakly positive magnetic anomaly with a second linear anomaly at 4005, they are interpreted as possible archaeology (weak response) and are potentially part of the same larger feature possibly a ditched enclosure. They are possibly associated as part of each anomaly is on the same alignment and in a similar orientation. There are ploughing trends over this area and several linear and curvilinear trends of uncertain origin.
- 3.2.37 There are few anomalies of interest at 4006 aside from a few small oval shaped anomalies of possible archaeology (weak response) that could be cut features such as pits or postholes, a number of these are present across the Site and are interpreted in the same manner. They are irregular in their distribution and they do not show a particular concentration to aid further characterisation.
- 3.2.38 There is a ceramic field drain present at 4008 but this is the only one identified within the survey.
- 3.2.39 There are numerous linear trends visible across the Site which are interpreted as ploughing trends and are considered to be relatively modern in date. In the larger field to the west the trends are orientated north-west to south-east and in the field to the east the trends are orientated north-east to south-west. The trends are especially visible at 4009.
- 3.2.40 There are a large number of ferrous anomalies throughout the Site but there is a slightly higher concentration of bipolar and dipolar anomalies in two areas and these have been identified as areas of increased magnetic response. While a number of the ferrous anomalies are probably modern bits of ferrous debris associated with agricultural activity in the area it is also may be due to industrial activity. The anomalies could represent pieces of ceramic or tile or brick distributed throughout the Site by successive years of ploughing. There is therefore the possibility that they could be of medieval or post-medieval in date as well as relatively modern.
- 3.2.41 Around 4010 are at least 4 areas of broad irregular shaped linear anomalies that have been interpreted as natural in origin and possibly represent deposits of weakly magnetic sediment.

Conclusions

Discussion

- 3.2.42 Only one anomaly has been characterised as archaeology at 4000 but several more anomalies have been identified as possible archaeology(weak response) at 4001-4005 which also have the

potential to be features such as ditches and pits but their weak magnetic value has limited the amount of confidence that can be ascribed to their interpretation.

- 3.2.43 One possible explanation for the weak magnetic values seen for lots of anomalies in the survey area, such as at 4001, is that a large number of ploughing trends have been identified right across the Site possibly causing plough damage to the features and resulting in the weakly contrasted anomalies seen here. Indeed plough damage has been described on several of the HER records from this area where successive aerial photographs have been compared over the same site (PastScape ID 1528220). This could be evident in the area of 4009 where multiple linear trends interpreted as ploughing trends have resulted in an area where little or even no anomalies of archaeological potential have been identified perhaps due to their being ploughed out. This is relevant right across the site where many anomalies have been identified as possible archaeology (weak response).
- 3.2.44 The two large areas of increased magnetic response have been interpreted as anthropogenic in origin either representing a large amount of ferrous debris or possibly due to industrial activity which is known to exist in the area indicated by the existence of two brick kilns recorded at Ufton (see above).
- 3.2.45 It should be noted that small, weakly magnetised features may produce responses that are below the detection threshold of magnetometers. It may therefore be the case that more archaeological features may be encountered than have been identified through geophysical survey. Given how weak many of the features interpreted in this data are it seems very likely that more features may be present than were detected during the survey.

References

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- Soil Survey of England and Wales (1983), Sheet 3, Soils of Midland and Western England. Ordnance Survey: Southampton.
- Ordnance Survey (1977), Quaternary Map of the United Kingdom: South. Ordnance Survey: Southampton.
- Ordnance Survey (1957), Sheet 2, Geological Map of Great Britain: England and Wales. Ordnance Survey: Chessington.
- Wessex Archaeology (2013), *HS2: Geophysical Survey Written Scheme of Investigation*. Report Reference: 86254.01.

HER records consulted

- MWA6788 – possible enclosures 100m NE of Wood Farm, Ufton
- MWA8889 – ancient charter boundary relating to Long Itchington, the site of the parish boundary between Ufton and Long Itchington Wood
- MWA827 – site of brick kiln 400m NW of Ufton Church
- MWA828 – site of lime kiln 800m N of Church and there is extensive evidence of quarrying within the field which is located 100m north of the church at Ufton

- MWA7090 – brickworks at Brickyard Cottage300m northwest of the church at Ufton
- MWA9538 – medieval settlement of Ufton
- MWA7542 – remains of buildings and ridge and furrow, medieval in date, 500m south of church at Ufton
- MWA6224 – possible deserted medieval settlement 200m south-west of church at Ufton
- MWA4304 – Bascote Locks, double lock
- MWA4319 – toll house over Grand Union Canal
- MWA8097 – WWII anti-tank road block

English Heritage PastScape records

- Monument No. 1528220 – a probably Medieval or Post Medieval mound or spoil heap visible as a cropmark
- Monument No. 1528249 – a probably Medieval or Post Medieval mound or spoil heap is visible as a cropmark on aerial photographs. The site comprises a sub-circular mound which measure 37m in diameter. The site superficially resembles a ploughed out round barrow, but it appears to be on the top of ridge and furrow.
- Monument No. 1528168 – a partly dispersed, partly contiguous area of Medieval or Post Medieval ridge and furrow
- Monument No. 1417804 – Second World War Pillbox 1940-1941
- Monument No. 1531887 – a partly dispersed, partly contiguous area of Medieval or Post Medieval ridge and furrow

Figures

Figure 13: Site location

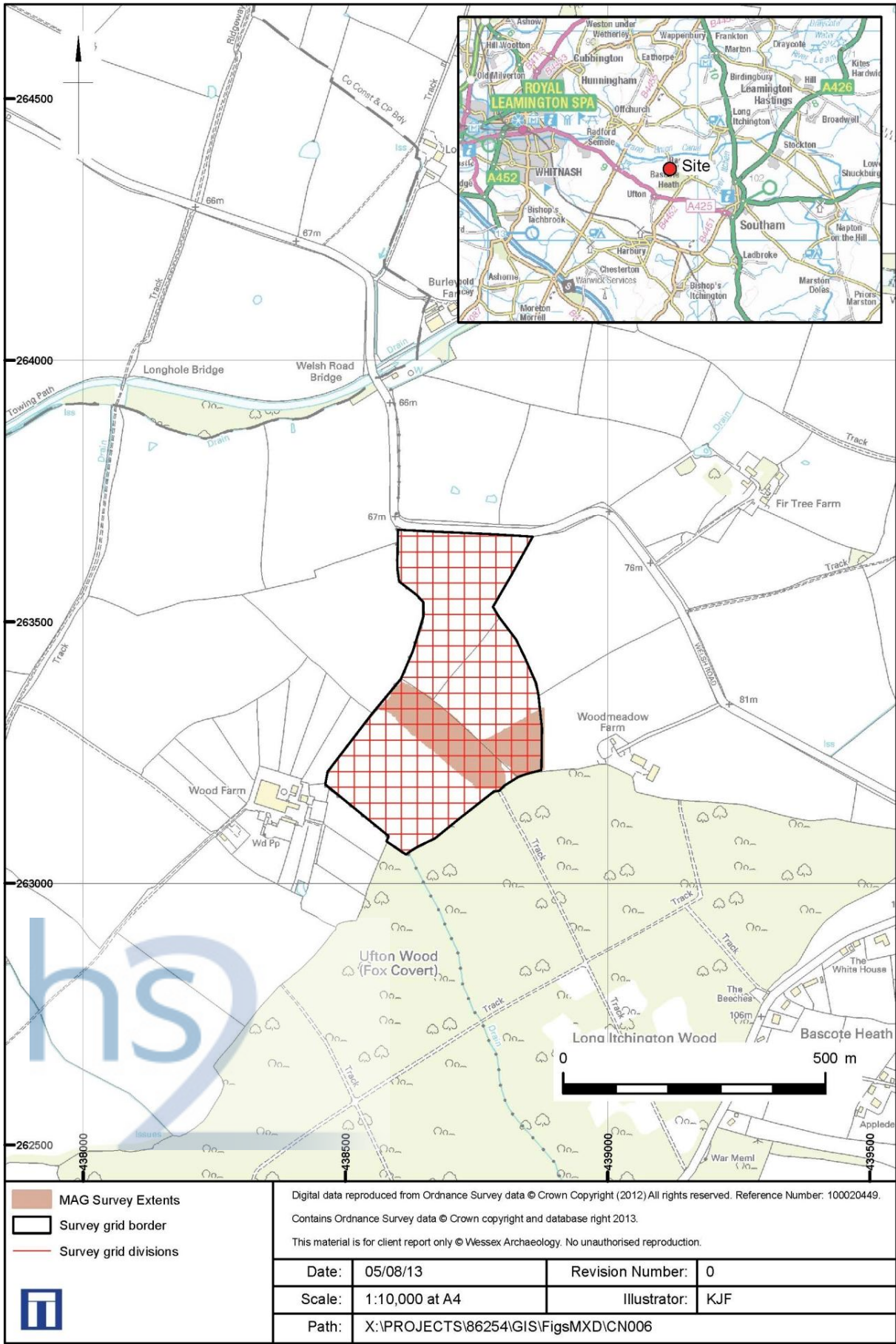


Figure 14: Greyscale plot



Figure 15: XY trace

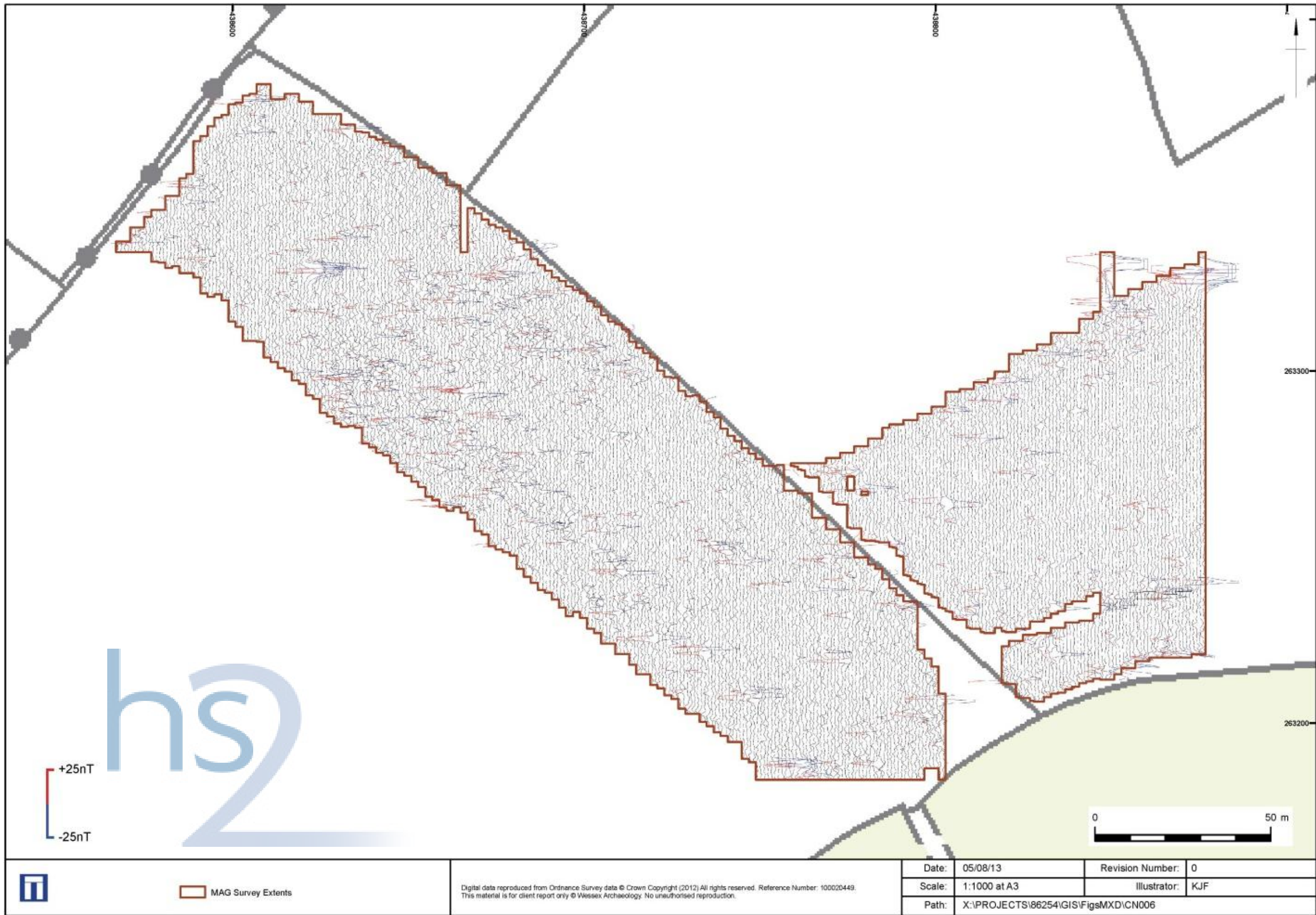
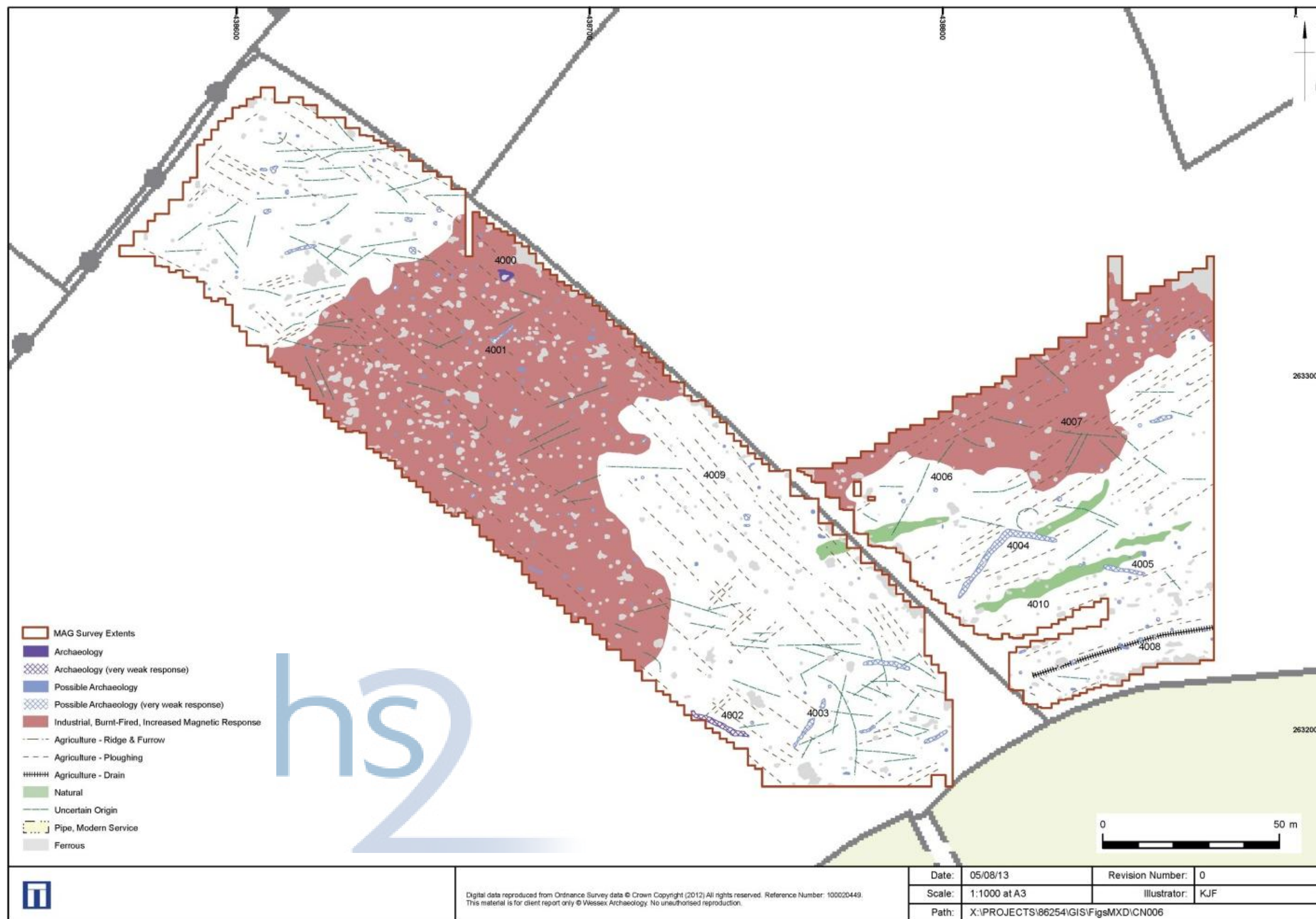


Figure 16: Interpretation



3.3 Appendix 1: Survey equipment and data processing

Survey methods and equipment

- 3.3.1 The magnetic data for this project was acquired using a Bartington 601-2 dual magnetic gradiometer system. This instrument has two sensor assemblies fixed horizontally 1m apart allowing two traverses to be recorded simultaneously. Each sensor contains two fluxgate magnetometers arranged vertically with a 1m separation, and measures the difference between the vertical components of the total magnetic field within each sensor array. This arrangement of magnetometers suppresses any diurnal or low frequency effects.
- 3.3.2 The gradiometers have an effective resolution of 0.03nT over a ± 100 nT range, and measurements from each sensor are logged at intervals of 0.25m. All of the data are stored on an integrated data logger for subsequent post-processing and analysis.
- 3.3.3 Wessex Archaeology conducts detailed gradiometer surveys using an accurate 20m or 30m site grid, which is achieved using a Leica Viva RTK GNSS instrument and then extended using tapes. The Leica Viva system receives corrections from a network of reference stations operated by the Ordnance Survey and Leica Geosystems, allowing positions to be determined with a precision of 0.02m in real-time and therefore exceed the level of accuracy recommended by English Heritage (2008) for geophysical surveys.
- 3.3.4 The detailed surveys consist of 20m x 20m or 30m x 30m grids, and data are collected at 0.25m intervals along traverses spaced 1m apart. These strategies give 1600 or 3600 measurements per 20m or 30m grid respectively, and are the recommended methodologies for archaeological surveys of this type (EH 2008).
- 3.3.5 Data may be collected with a higher sample density where complex archaeological anomalies are encountered, to aid the detection and characterisation of small and ephemeral features. Data may be collected at up to 0.125m intervals along traverses spaced up to 0.25m apart, resulting in a maximum of 28800 readings per 30m grid, exceeding that recommended by English Heritage (2008) for characterisation surveys.

Post-processing

- 3.3.6 The magnetic data collected during the detail survey are downloaded from the Bartington system for processing and analysis using both commercial and in-house software. This software allows for both the data and the images to be processed in order to enhance the results for analysis; however, it should be noted that minimal data processing is conducted so as not to distort the anomalies.
- 3.3.7 As the scanning data are not as closely distributed as with detailed survey, they are georeferenced using the GPS information and interpolated to highlight similar anomalies in adjacent transects. Directional trends may be removed before interpolation to produce more easily understood images.
- 3.3.8 Typical data and image processing steps may include:
- destripe – applying a zero mean traverse in order to remove differences caused by directional effects inherent in the magnetometer;
 - destagger – shifting each traverse longitudinally by a number of readings. This corrects for operator errors and is used to enhance linear features;

- despoke – filtering isolated data points that exceed the mean by a specified amount to reduce the appearance of dominant anomalous readings (generally only used for earth resistance data);
- deslope – this function is used to remove a linear trend within a data set. It is most commonly used to remove grid edge discontinuities that can result from applying zero mean traverse to a data set; and
- multiply – the multiply function multiplies the data by a negative or positive constant value. It has a variety of functions but its typical use is to normalise data that has been collected with sensors at different heights from the ground.

3.3.9 Typical displays of the data used during processing and analysis:

- XY plot – presents the data as a trace or graph line for each traverse. Each traverse is displaced down the image to produce a stacked profile effect. This type of image is useful as it shows the full range of individual anomalies; and
- greyscale – presents the data in plan view using a greyscale to indicate the relative strength of the signal at each measurement point. These plots can be produced in colour to highlight certain features but generally greyscale plots are used during analysis of the data.

3.4 Appendix 2: Geophysical interpretation

Interpretation categories

- 3.4.1 The interpretation methodology used by Wessex Archaeology separates the anomalies into two main categories: archaeological and unidentified responses.
- 3.4.2 The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided into three groups, implying a decreasing level of confidence:
- 3.4.3 Archaeology – used when there is a clear geophysical response and anthropogenic pattern.
- 3.4.4 Possible archaeology – used for features which give a response but which form no discernible pattern or trend.
- 3.4.5 The unidentified category is used for features when the form, nature and pattern of the anomaly are not sufficient to warrant a classification as an archaeological feature. This category is further sub-divided into:
- industrial, burnt-fired, increased magnetic response – used for areas dominated by bipolar and dipolar anomalies which may have some archaeological potential;
 - uncertain origin – used for low amplitude or indistinct linear anomalies;
 - ferrous – used for responses caused by ferrous material. These anomalies are likely to be of modern origin;
 - agricultural – used for linear trends that can be shown to relate to agricultural activity including ridge and furrow, drainage and ploughing scars; and

- natural – used for spreads of anomalies that are considered to be geological or more discrete anomalies considered to be natural.

3.4.6 Finally, services such as water pipes are marked where they have been identified along with ceramic field drains.